

Remarks

Claims 4-5, 14-26, 28-29 and 43 were previously cancelled. Claims 30-39 were previously withdrawn in response to a restriction requirement without prejudice to file these claims in a divisional application, and applicant has cancelled these claims in this paper without prejudice. Accordingly, claims 1-3, 6-13, 27, 40-42 and 44-50 are currently pending.

In the Office Action mailed on January 26, 2007, the examiner rejected claims 1-3, 6-12, 27, 40-42 and 44-50. Claim 13 was objected to as being dependent upon a rejected base claim, but the examiner indicated that claim 13 would be allowable if rewritten in independent form.

Claim 13 has been rewritten in independent form and is in condition for allowance.

In the January 26, 2007 Office Action, the examiner has maintained the previous rejection of claims 1-3, 6-12, 27, 40-42 and 44-50 under 35 U.S.C. §103(a). The examiner found that applicant's arguments regarding Evans, WO96/37570 were not persuasive because (1) all disclosures of the prior art, including non-preferred embodiments, must be considered, and (2) a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Applicant respectfully submits that the examiner has misapprehended the Evans WO96/37570 reference and applicant's arguments.

Claims 1-3, 6-12, 27, 40-42 and 44-50 recite non-aqueous heat transfer fluids comprising ethylene glycol (EG) and propylene glycol (PG). As recited in claims 1-3, 6-12, 27, 40-42, and 44-50, the non-aqueous heat transfer fluids comprise between greater than 60%

by weight to about 70% by weight EG of the total weight of EG and PG glycol in the heat transfer fluid.

Evans WO96/37570 teaches that it is generally undesirable to include EG with PG in a non-aqueous heat transfer fluid, but that if EG is used, the concentration should be limited to less than 60% by weight EG. In paragraph 0047 Evans WO96/37570 states, "The use of EG in a mixture with PG, however, is not as beneficial as using PG alone because of increased toxicity." Prior to the disclosure of the present application, persons skilled in the art understood that adding EG to PG resulted in a fluid that was toxic, just as adding EG to water results in a fluid that is toxic. Evans Declaration at ¶ 3. The statements regarding toxicity in Evans WO96/37570, (which would be in agreement with others skilled in the art at the time) reflected the belief at the time that the addition of EG to PG would destroy the non-toxic advantage that PG enjoyed. PG is generally regarded as safe [GRAS] by the U.S. Food and Drug Administration, enjoys.

The non-aqueous fluids claimed in the present application are not non-preferred embodiments described in Evans WO96/37570. The non-aqueous heat transfer fluids of the amended claims are not embodiments of the fluid described in Evans WO96/37570 at all. In fact, Evans teaches away from non-aqueous heat transfer fluids having greater than 60% by weight EG such as those presently claimed. Evans WO96/37570 teaches that fluids containing greater than 60% by weight EG are undesirable based upon the common understanding at the time that fluids containing greater levels of EG had an unacceptable toxicity. Evans Declaration at ¶ 5. The breakthrough that motivated greater concentrations of EG in mixtures with PG was the later unexpected discovery by the applicant, as described in detail in the specification and in the Declaration of John Evans submitted herewith, that PG

acts as an inhibitor against EG poisoning when it is mixed with EG. Because the claimed heat transfer fluids are not embodiments described in Evans WO96/37570 at all, and in fact are contrary to the teachings of Evans WO96/37570, the claimed non-aqueous heat transfer fluids are not obvious in view of Evans WO 96/37570. See In re Hedges, 783 F.2d 1038 (proceeding contrary to accepted wisdom in the art is evidence of nonobviousness).

The examiner's argument that there is a prima facie case of obviousness established because the range in Evans WO96/37570 is sufficiently close to the claimed range that one skilled in the art would have expected them to have the same properties is also misplaced. As explicitly stated in Evans WO96/37570 and in the Declaration of John Evans submitted herewith, one skilled in the art expected that a non-aqueous EG/PG heat transfer fluid could not contain more than 60% by weight ethylene glycol due to unacceptably high oral toxicity. As explained in the Evans Declaration, at the time of Evans WO96/37570, those skilled in the art believed that addition of EG to a heat transfer fluid would increase the toxicity of the fluid to unacceptable levels. Therefore, one skilled in the art did not expect that higher levels of EG in the heat transfer fluid would result in a fluid that had the same properties regarding toxicity. To the contrary, the expectation was that higher levels of EG resulted in unacceptably high toxicity. The presently claimed invention is based upon the unexpected discovery that non-aqueous EG/PG heat transfer fluids can contain greater than 60% EG with much lower oral toxicity than was expected or predicted.

The examiner has not pointed to any teaching or statement in Evans WO96/37570 that would indicate to one skilled in the art that addition of greater than 60% EG to PG would result in a heat transfer fluid having lower than expected toxicity. It is only by relying upon

hindsight and reading the prior art in view of the disclosure of the present application that the examiner can reach this conclusion.

Evans WO96/37570 further teaches away from mixtures containing greater than 60% EG also by his statement that “in order to retain the present invention’s other characteristics [other than toxicity] the mixture must contain at least 40% PG.” These other characteristics relate to the physical properties of the fluid, including the atmospheric boiling point and the freezing point.

The atmospheric boiling points of both PG and EG (187.2° C and 197.3° C, respectively), are very much hotter than the boiling point of water (100° C). In an engine cooling system, boiling of coolant occurs locally at locations where large amounts of heat are generated and the surface area in contact with liquid coolant is small. As long as the vapor from the boiling condenses almost immediately into surrounding coolant, metal temperatures at the boiling locations are controlled to temperatures that are close to the boiling point of the fluid.

In the case of water/glycol heat transfer fluids, the vapor from localized boiling is almost entirely water vapor. The water vapor may not condense readily because the surrounding water/glycol heat transfer fluid can often be hotter than the saturation temperature of water. In that event, a blanket of water vapor forms and insulates the engine metal at that location from the liquid heat transfer fluid, resulting in sharply increased metal temperatures that are no longer related to the thermal characteristics of the heat transfer fluid in its liquid state.

Vapor blanketing is easily avoided with a high boiling point non-aqueous coolant because it is easy to maintain the bulk coolant substantially cooler than the saturation

temperature of the coolant. With both PG and EG, the metal temperatures at boiling locations are easily controlled as a function of their respective boiling points. In addition to avoiding vapor blanketing, however, controlling metal temperatures to reasonable levels also requires that the boiling point of the coolant not be too high. The boiling point of PG is 10° C colder than the boiling point of EG. Evans in WO96/37570 states that “Propylene glycol has a satisfactory boiling point of 369° F (187.2° C), but the boiling point of ethylene glycol, 387.1° F (197.3° C), is at the upper limit for acceptable boiling points.” Evans WO96/37570 implies that it is desirable to ensure that the EG and PG mixture contains at least 40% PG to avoid potential metal heating issues, as all such mixtures avoid pressing the stated upper limit for an acceptable boiling point.

Evans WO96/37570 also describes concern regarding the freezing point of mixtures of EG and PG. PG and EG freeze at -60° C and -13.5° C, respectively. It was obvious that the high freezing temperature of neat EG was unsuitable for a heat transfer fluid that could be used without modification in virtually any environment in the world. A mixture of EG and PG containing at least 40% PG has an upper freezing point limit of about minus 42° C. This is close to the upper freezing point limit that would be required for a heat transfer fluid for use in all environments, the desired attribute of a “world coolant”. (As described in the present application at paragraph 0054, the freezing point of a 30/70 EG/PG mixture is minus 35°F, which is satisfactory in nearly all environments, but would not be satisfactory in the most severe arctic environments.)

Evans WO 96/37570 clearly teaches against mixtures of EG and PG wherein the PG portion is less than 40 percent. Because it was believed that mixtures of EG and PG with less than 40 percent PG would have undesirable toxicity characteristics, would be close to the

upper limit of acceptable boiling points, and would raise the freezing temperature beyond an acceptable level for use in all environments, it was not obvious to one of ordinary skill in the art to pursue a non-aqueous heat transfer fluid comprising EG and PG having less than 40 percent PG.


In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes after considering these remarks, that the application is not in condition for allowance, and in particular if a terminal disclaimer is required for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

Because the reasons above are sufficient to traverse the rejection, Applicants have not explored, nor do they now present, other possible reasons for traversing such rejections. Nonetheless, Applicants expressly reserve the right to do so, if appropriate, in response to any future Office Action.

No fee is believed to be required. However, if a fee is required or otherwise necessary to cover any deficiency in fees previously paid, authorization is hereby given to charge our Deposit Account No. 50-3569.

Respectfully submitted,

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